



Teenage Boy with Chest Pain and Difficulty Breathing

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A 16-year-old boy presents to the emergency department with the acute onset of chest pain and difficulty breathing. The symptoms began at school this morning during end-of-grade examinations, and they have worsened throughout the day. He was previously well, has no history of respiratory or cardiovascular disease, has not been traumatized, and has not been exercising strenuously. He denies ingesting any aspirin during the last month. He complains of dizziness, shortness of breath, tingling in his hands and feet, and squeezing substernal chest pain that radiates down the left arm. Physical examination reveals an awake, hyperalert boy who has air hunger. His pupils are equal and reactive; his upper airway is open and quiet; and he has suprasternal, costal, and subcostal retractions. His chest has a normal anteroposterior diameter and bilateral breath sounds are clear. His respiratory rate is 35 breaths/min. His heart has regular tachycardia without murmur, gallop, or rub. Distal pulses are 1+, and his hands are pale and clammy. His heart rate is 138 beats/min and blood pressure is 120/82 mm Hg. His abdomen is soft with no mass.

Of the following, the test MOST likely to establish the diagnosis is

- A. arterial blood gas
- B. chest radiography
- C. electrocardiography
- D. plasma troponin-I assessment
- E. targeted questionnaire

Answer on page 23

El Paso Physician TV Show Highlights

TOPIC: Advances in Breast Cancer – Past, Present & Future

DATE: January 31, 2013

SPONSOR: Texas Tech University HSC at El Paso

Breast cancer specialists Zeina Nahleh, M.D., Edward Saltzstein, M.D. and Victor Olivas, M.D., discussed advances in breast cancer research, types of breast cancer and treatment options. They also shared the history of the TTUHSC University Breast Care Center, the role it's played for over 18 years, and the significance of its recent designation as El Paso's only nationally accredited breast cancer program.

TOPIC: Hearts and Rhythm

PANEL: Moeen Abedin, M.D., Oscar Munoz, M.D. and David Gough, M.D.

DATE: February 28, 2013

SPONSOR: Del Sol Medical Center

"I really enjoyed my appearance on The El Paso Physician this month. The format of the show is great because it is interactive and informative. We had an excellent discussion about cardiac arrhythmias, and heart disease in general. The show helps us fill an important need, which is one of the missions of my practice; to help keep patients well informed not only about the latest, up-to-date treatments available but also what can be done to try to avoid cardiac problems in the first place. Thank you to the El Paso County Medical Society, Del Sol Medical Center and KCOS for producing this valuable service, both for the medical community and the people of El Paso.

Moeen Abedin, M.D.





Teenage Boy with Chest Pain and Difficulty Breathing (Continued)

E: The history and physical examination findings described for the boy in the vignette indicate acute distress and hyperventilation, but they do not reveal an obvious organic source. Cardiorespiratory symptoms and signs predominate, although anxiety is an important finding. The examining physician probably will use arterial blood gas, chest radiography, electrocardiography, plasma troponin-I assessment, and targeted questionnaire to rule out organic disease, but the presentation is most consistent with the anxiety hyperventilation syndrome, the most common cause of hyperventilation. Anxiety hyperventilation syndrome does result in abnormal arterial blood gas values, but the most sensitive and specific diagnostic test is the Nijmegen questionnaire.

Hyperventilation can have many physiologic and psychological sources. The brainstem respiratory centers establish regular, rhythmic breathing and can mediate hyperventilation if metabolic acidosis is present or if they are compressed due to brain masses, hydrocephalus, or pseudotumor cerebri. More commonly, inputs external to the brainstem initiate hyperventilation. Cerebral cortical inputs can override the physiologic mechanisms that regulate acid-base status and can cause frank acidosis or alkalosis. The cortical inputs that accompany hyperventilation are anxiety, pain, and volition. They are extremely common and account for most cases of hyperventilation and respiratory alkalosis in the spontaneously breathing patient.

Hyperventilation affects primarily the respiratory, neurologic, and cardiovascular systems. Adult lungs can excrete 13,000 mEq of acid each day compared with the renal capacity to excrete 80 mEq of acid. At the onset of hyperventilation, a rapid and profound rise in pH occurs. The hypocarbia mediates cerebral vasoconstriction and may lead to paresthesias, light-headedness, syncope, hallucinations, and altered vision. The systemic vascular resistance falls, blood pressure declines, and cardiac output increases. Cutaneous vasoconstriction occurs, associated with cold extremities. Hypocarbia mediates a decrease in coronary blood flow at a time when the cardiac output is increased. A decrease in myocardial oxygen supply may occur, and chest pain may ensue. Chest pain and perceived respiratory insufficiency worsen the anxiety that initiated the hyperventilation episode, resulting in a positive feedback loop.

The Nijmegen Questionnaire is a survey of the frequency at which the patient experiences 16 symptoms of anxiety with hyperventilation (see: <http://www.bmj.com/cgi/content/full/322/7294/1098/T1>). It has been 91% specific and 95% sensitive in differentiating hyperventilation syndrome from healthy individuals. Although it has not been used to differentiate hyperventilating individuals from those who have organic cardiopulmonary disease, it has found long-term use as a diagnostic tool.

As noted, arterial blood gas analysis is likely to show respiratory alkalosis for the patient described in the vignette almost regardless of the presence or absence of organic cardiopulmonary disease. Its poor specificity limits its usefulness. It can rule out diseases associated with metabolic or respiratory acidosis, but in the absence of historical or physical examination evidence of such disorders, they are much less common than anxiety with hyperventilation.

Chest radiography is a good diagnostic test for many causes of respiratory distress. Among organic causes of hyperventilation, it

can show or suggest restrictive chest wall disease, pulmonary edema, pneumonia, interstitial pneumonitis, asthma, pneumothorax, hemothorax, and pulmonary fibrosis. The prior good health of the patient described in the vignette make these diagnoses much less likely than the anxiety hyperventilation syndrome.

Electrocardiography and plasma troponin-I assessment may help to rule out myocardial ischemia or infarction, heart rhythm disturbance, and hypertrophic cardiomyopathy. Of these, hypertrophic cardiomyopathy is the most common in a teenager who is believed to be previously well. However, the incidence of hypertrophic cardiomyopathy is much lower than that of hyperventilation syndrome.

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RETRACTION

El Paso Physician magazine Volume 35 Number 6. Article "Just A Virus," Jessica Ogawa, MSIV was omitted as a coauthor.